MULTIMEDIA UNIVERSITY

**STUDENT ID NO**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2017/2018**

**BEM1014 – MATHEMATICS**
( All sections / Groups )

11 OCTOBER 2017
9.00 a.m - 11.00 a.m
( 2 Hours )

---

**INSTRUCTIONS TO STUDENT**

1. This Question paper consists of **6 pages** including cover page with **4 Questions** only.
2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.
3. Mathematical formulas are provided at the end of the paper.
4. The candidate is allowed to use scientific calculators that are permitted to be used in the examination.

## Question 1 (20 marks)

(a) Solve the linear equation $3p + 2(p - 1) = -2p - 4$

**[3 marks]**

(b) ThermoMaster manufactures an indoor-outdoor thermometer at its Mexican subsidiary. Management estimates that the profit (in dollars) realizable by ThermoMaster in the manufacture and sale of $x$ thermometers per week is

$$P(x) = -0.001x^2 + 8x - 5000$$

Find ThermoMaster's weekly profit if its level of production is

(i) 1000 thermometers per week

**[3 marks]**

(ii) 2000 thermometers per week

**[3 marks]**

(c) Solve $\sqrt{y-2} + 2 = \sqrt{2y+3}$.

**[5 marks]**

(d) The market equilibrium point for a book occurs when 13500 units are sold at a price of RM4.50 per unit. The publisher will supply no units at RM1, and the buyers will demand no units at RM20. If both the supply and demand equations are linear, find the

(i) supply equation **[3 marks]**

(ii) demand equation **[3 marks]**

**Continued...**

## Question 2 (20 marks)

Olynn Enterprise wishes to produce two types of dining table: Type M and Type N. Each Type M table will result in a profit of $1000, and each Type N table will result in a profit of $1200. To manufacture a Type M table requires 2 hours on Machine X and 1 hour on Machine Y. A Type N table requires 1 hour on Machine X and 3 hours on Machine Y. There are 180 hours available on Machine X and 300 hours available on Machine Y. How many dining table of each type should Olynn make to maximize its profit?

| | Type M | Type N | Time Available |
|---|---|---|---|
| **Machine X** | 2 | 1 | 180 |
| **Machine Y** | 1 | 3 | 300 |
| **Profit** | 1000 | 1200 | - |

*Table 1*

(a) Formulate a linear programming model for this problem. **[5 marks]**

(b) Solve the LP problem graphically and state the optimal solution. **[15 marks]**

## Question 3 (25 marks)

(a) How many monthly payments of $100 must be planned to have a future value of $1,878.58 when the interest is 6% compounded monthly? **[5 marks]**

(b) Quantum Landscaping Company wants to build a $250,000 greenhouse in 3 years. The company sets up a sinking fund with payments made quarterly. Find the quarterly payment into this fund if the money earns 5% compounded quarterly. **[5 marks]**

(c) Aneesa bought a second-hand car with a down payment of $300 and payments of $200 per month for 3 years. If the interest rate is 4% compounded monthly, what is the total cost of the car? **[5 marks]**

(d) Uthman borrows $125,000 at 3.6% for 15 years to purchase a house. What is his monthly payment? **[5 marks]**

(e) A debt of RM1500 due in five years and RM2000 due in seven years is to be repaid by a payment of RM2000 now and a second payment at the end of three years. How much should the second payment be if interest is at 3% compounded annually? **[5 marks]**

**Continued...**

## Question 4 (35 marks)

(a) A group of marine biologist at the Neptune Institute of Oceanography recommended that a series of conversation measures can be carried out over the next decade to save a certain species of whale from extinction. After implementation of the conversation measures, the population of this species is expected to follow the function

$$N(t) = 3t^3 + 2t^2 - 10t + 600 \qquad (0 \le t \le 10)$$

where $N(t)$ denotes the population at the end of year $t$. Find the rate of growth of the whale population when $t = 2$ and $t = 6$. How large will the whale population be 8 years after implementing the conversation measures?

**[5 marks]**

(b) Suppose the relationship between the unit price $p$ in dollars and the quantity demanded $x$ of the Acrosonic model F loudspeaker system is given by the equation

$$p = -0.02x + 400 \qquad (0 \le x \le 20{,}000)$$

(i) Find the revenue function $R$ **[3 marks]**

(ii) Find the marginal revenue function $R'$ **[1 marks]**

(iii) Compute R'(2000), and interpret your result **[2 marks]**

(c) Differentiate $y = 4x^2\sqrt{5x+1}$. **[5 marks]**

(d) If $f(x,y) = e^{xy^2}$, find $f_{xx}(2,3)$ and $f_{xy}(2,3)$. **[5 marks]**

(e) Find each of the following:

(i) $\int \left(\sqrt{x} + \frac{2}{\sqrt{x}}\right) dx$ **[2 marks]**

(ii) $\int_1^3 (3x^2 + e^x)dx$ **[5 marks]**

(f) Find the area of the region R bounded by $y = x^2 + 1$ as the top curve and $y = x - 6$ as the below curve from $x = -1$ to $x = 3$.

**[7 marks]**

**End of Page.**

**Course: Mathematics**
**Code: BEM 1014**

## Summary of Principal Formulas and Terms

### Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)
(ii) Accumulated amount, $A = P(1 + rt)$

### Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \dfrac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

### Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

### Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$

(S = future value of ordinary annuity of n payments of R dollars periodic payment)

### Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

(P = present value of ordinary annuity of n payments of R dollars periodic payment)

### Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$

(R = periodic payment on a loan of P dollars to be amortized over n periods)

### Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$

(R = periodic payment required to accumulate S dollars over n periods)

### Basic Rules of Differentiation

(a) Chain rule: Derive $g[f(x)] = g'[f(x)]f'(x)$
(b) General power rule: Derive $[f(x)]^n = n[f(x)]^{n-1} f'(x)$
(c) Exponential function: Derive $e^x = e^x$
Derive $(e^u) = e^u[u'(x)]$

(d) Logarithmic function: Derive $\ln x = \frac{1}{x}$

Derive $(\ln u(x)) = \left(\frac{1}{u(x)}\right)[u'(x)]$

**Basic Rules of Integration**

(a) Exponential function: $\int e^{u} du = e^{u} + C$

(b) Logarithmic function: $\int \left(\frac{1}{u}\right) du = \ln u + C$

## 13. Determining Relative Extrema

$$D(x, y) = f_{xx} f_{yy} - (f_{xy})^2$$

If D > 0 and $f_{xx} > 0$, relative minimum point occurs at $(x, y)$.
If D > 0 and $f_{xx} < 0$, relative maximum point occurs at $(x, y)$.
If D < 0, $(x, y)$ is neither maximum nor minimum.
If D = 0, the test is inconclusive.